INDEX

N-Acetylaspartylglutamate 251
Acetylcholine
  in brain, effect of organophosphorus compounds 118
  release, effect of organophosphorus compounds 119
  synthesis and degradation 100
    effect of organophosphorus compounds 117
  transmitter role in retina 74
Acetylcholine receptors
  desensitization 243
  organophosphorus sensitivity 108, 119, 120
Acetylcholinesterase
  organophosphorus binding 105
  selective modification of isoenzymes by organophosphorus compounds 117
  sex differences in inhibition by DFP 106
Acetyl CoA, organophosphorus compounds and glucose utilization 107
Acidic amino acids as neuroexcitants
  cell culture 212
  extracellular recording 206
  intracellular recording 207
Adaption, cholinergic system, organophosphorus anticholinesterases 102, 112
Adaptive and context-dependent postural and locomotor controls 187
Adenosine-3′,5′-monophosphate, opiate interactions in invertebrates 144
Adenylate cyclase, in invertebrates, effect of opiates 144
Adrenal gland
  hypothalamic connections 26
  preganglionic innervation 41
Adrenal hormones, paraventricular hypothalamic nucleus and release of 4
Adrenocorticotropic hormone 26, 49
Aging, invertebrates
  opioid content 146
  opioid function 148
  opioid receptors 146
Aging, mammals
  opioid content 144
  opioid function 147
  opioid receptors 146
Aliesterase, role in organophosphate sensitivity 106
Amacrine cells 58
  acetylcholine in 74
  dopaminergic 80
  GABAergic 73
  glycine uptake 66
  5-hydroxytryptamine in 82
  indoleamine systems in 83
Amino acids
  blood–brain barrier 289
  imbalance in hepatic encephalopathy 277–301
  treatment of hepatic encephalopathy 293
D-α-Aminoadipic acid 201, 247
γ-Aminobutyric acid
  co-localization with enkephalin in retina 86
  effect on locomotion in decerebrate cat 164
  effect of organophosphorus anticholinesterases on metabolism 109, 121
  transmitter role in retina 60, 70
3-Amino-1-hydroxy-2-pyrrolidone 246
2-Amino-4-phosphonobutyric acid 203, 256
2-Amino-7-phosphonoheptanoic acid, effect in retina 61, 64
2-Amino-5-phosphonovaleric acid 202, 203, 247
  effect in retina 64
Amygdalo-hypothalamic organization 11, 13
Analgesia, aging 147
Anaesthetics, effect on NMDA receptors 205
Annelids, opioids in 150
Anterior hypothalamic nucleus, intrahypothalamic connections 25
Anterograde-tracer techniques 6, 11
  midpontine structures 168
Anteroventral cochlear nucleus, excitatory amino acids 248
Aplysia, opiate mechanisms 143
Aromatic amino acids, imbalance in liver disease 278
Aspartate
  excitatory action 206, 238
  in retina 59
Auditory systems, effect of excitatory amino acid antagonists 248
Autonomic nervous system
  connections of ventromedial hypothalamic nucleus 27
  descending connections of dorsomedial hypothalamic nucleus 37
  descending connections of lateral hypothalamic area 35
  descending connections of paraventricular hypothalamic nucleus 38
Autonomic postural and locomotor control system in decerebrate cats 171
Axonal transport 6

Baroreceptors, effect of excitatory amino acid antagonists 249
Behaviour
  arousal 183
  invertebrates, effect of opiates 149
  effect of organophosphorus anticholinesterases 121
Bipolar cells 57
  excitatory? 62
  glutamate as a transmitter 62
  glycine accumulation 68
Blood–brain barrier
  amino acid transport 289
  organophosphate-induced changes 111
  role in hepatic encephalopathy 288, 291
Blood–nerve barrier 305, 319, 329
  transfer of nonelectrolytes 332
Brain slices, action of excitatory amino acids 209
Branched chain amino acids
  imbalance in plasma in hepatic encephalopathy 278
  utilization in treatment of hepatic encephalopathy 294

Calcium
  effect on NMDA receptors 220
  permeability of NMDA receptor activated channel 238
  transport in perineurium 327

Cat
glycine in retina 66, 70
integration of posture and locomotion 161–195
Caudal tegmental field 165
excitatory power control system 176
inhibitory power control system 174
Cell culture, excitatory amino acid action 212
Cerebellum
excitatory amino acid effect on slices 211
excitatory amino acids and synaptic transmission 250
input and output signals, locomotion 178
postural and locomotor synergisms 186
Cerebrospinal fluid, amino acid levels in hepatic encephalopathy 285
Chloride
nerve capillary permeability 331
perineurial permeability 327
Choline
in brain, effect of organophosphorus compounds 118
effect of organophosphorus compounds on uptake 117
Cholinergic amacrine cells, retina 75
Cholinergic synapse 101
Cholinesterases, inhibition by organophosphorus compounds 116
Chromatophorotropin, regulation in crustacea 141
Cirrhosis
amino acids in treatment 293
blood–brain barrier amino acid transport 293
plasma amino acid imbalance 278, 280
Cobalt, effect on NMDA receptors 221, 230
Concanavalin A, effect on desensitization of excitatory amino acid receptors 242
Conductance mechanisms 212
Cone bipolar cells 57
transmitters in 61
Corticotropin releasing factor 26, 49
Crayfish, glutamate activated ion channels 234
Crustacea, opioid mechanisms in 141
Current clamp conductance 208, 215
Cutaneous afferences, H-reflex 353

Dala^2,met^5-enkephalinamide, binding in invertebrates 139, 140
Decerebrate cat, integration of posture and locomotion 163
Deiters' neuron, locomotion 179
Desensitization, excitatory amino acid receptors 240
models for 243
Development, effect of organophosphorus anticholinesterases 120
Diisopropylfluorophosphate
sensitivity to 105, 108
tolerance 112
Dopamine
effect of anticholinesterases on turnover 109, 121
role in retina 80
Dopamine–opioid interaction 139, 140, 143
aging 148
Dorsal spino-cerebellar tract 178
Dorsomedial hypothalamic nucleus
descending autonomic connections 37
intrahypothalamic connections 22
role in feeding and metabolism 4
Dynorphin 132

Endoneurial capillaries
glucose transport 334
morphology 305
nerve edema 329
permeability in hypertension 315
permeability to ions 331
permeability to sucrose 330
transfer of nonelectrolytes from blood into nerve 332
Endorphin 132
aging, mammals 145
in annelids 150
HPLC 135
in insects 151
proopiomelanocortin 132, 133
Enkephalins 132
aging, mammals 145
in annelids 150
binding in invertebrates 139
co-localization with GABA in retina 86
HPLC 135
macromolecular precursor in invertebrates 137
in molluscs 150
proenkephalin 133
Environment, posture 188
Epileptiform activity, role of excitatory amino acids 262
Evolution
opioid-like material in invertebrates 152
Excitatory amino acids 197–276
acidic amino acids as neuroexcitants 206
desensitization 240
fluctuation analysis and single channel recording 227
inhibitory responses to 214
invertebrates 234, 242
ionic mechanism 236
receptor pharmacology 200
synaptic activation of NMDA receptors 252
synaptic transmission, non-NMDA receptors 245
vertebrate–invertebrate differences 199
voltage clamp 217
Excitatory amino acid analogues 200
Excitatory amino acid antagonists 246
Excitatory postsynaptic currents 259

False neurotransmitter hypothesis of hepatic encephalopathy 281
Feeding
hypothalamic input from limbic structures 8
hypothalamic output to neuroendocrine system 26
hypothalamic projections to autonomic nervous system 27
intrahypothalamic circuitry 17
preganglionic innervation of pancreas and adrenal glands 41
role of hypothalamus 3
FK 33 824, binding in invertebrates 138, 142
Flinders Resistant/Sensitive line rats 105, 108, 114
Fluctuation analysis 227
ion channels linked to kainate and quisqualate receptors 233
ion channels linked to NMDA receptors 229

Gamma drive 351
Ganglion cells, retina 58

effect of acetylcholine 78
effect of glycine 70
Gecarcinus lateralis, opioid binding sites 140
Glial cells, effect of excitatory amino acids 238
Glucagon, effect on plasma amino acids 280
Glucose
effect of organophosphorus compounds on utilization 107
transport across nerve capillaries 334
Glutamic acid diethylester 204, 246
Glutamate
activated channels in invertebrates 234
affinity for NMDA and non-NMDA receptors 221, 234
bipolar cell neurotransmitter 62
desensitization 241
differences between vertebrate and invertebrate receptor-channel complexes 199
excitatory action 206, 207, 212, 236
firing patterns and bursting behaviour in response to 226
membrane conductance changes evoked by 223
neurotoxicity 239
photoreceptor transmitter 60
in retina 59
Glutamate receptors, retina 64
Glutamine, pathogenesis of hepatic encephalopathy 291
γ-D-Glutamylaminomethyl sulfonate 204, 248
γ-D-Glutamylglycine 204
Glycine, transmitter role in retina 65
Glycolysis, effect of organophosphorus compounds 107
Goldfish, glycine in retina 66

Helix pomatia, opiate mechanisms 142
Hepatic encephalopathy
amino acids in treatment of 293
brain and CSF amino acid levels 285
plasma amino acid imbalance 278
role of blood–brain barrier 288
High performance liquid chromatography, opioids 132
Hippocampus
action of excitatory amino acids on slices 210
effect of 2-amino-4-phosphonobutyric acid 256
projections to hypothalamus 14
role of excitatory amino acid receptors in long-term potentiation 254
synaptic activation of NMDA receptors 252
synaptic transmission and non-NMDA receptors 249
Hoffman reflex
effects from cutaneous afferences 353
excitability cycle 347
locomotion 355
methodology 346
modulation of excitability and voluntary movement 356
motoneuron vs reflex arc excitability 350
in muscles other than soleus 349
state-related changes 353
vestibular and neck receptor influences 354
Homocysteate, affinity for NMDA receptors 222
Horizontal cells 57
GABA systems in 60, 72
Horseradish peroxidase, retrograde transport 6, 8
caudal tegmental field 168
5-Hydroxytryptamine
role in anticholinesterase action 109
role in retina 82
Hyperammonemia, hepatic encephalopathy 291
Hypertension, nerve vascular permeability 306
Hypothalamus
amygdaloid projections to 13
autonomic connections to dorsomedial nucleus 37
autonomic connections to lateral area 35
autonomic connections to paraventricular nucleus 38
autonomic connections to ventromedial nucleus 27
control of feeding 3
forebrain limbic input to paraventricular nucleus 14
hippocampal projections to 14
intrahypothalamic circuitry 17
limbic inputs 8
metabolic regulatory functions 4
noradrenergic input 14
opioids and aging 145
output to neuroendocrine system 26
paraventricular nucleus 4
position in limbic system 2
prefrontal projections to 11
preganglionic innervation of endocrine pancreas and adrenal glands 41

Ibotenic acid 215
Indoleamine, in retina 83
Inner plexiform layer 57
electrophysiology 63
Insects, opioids in 151
Insulin
effect on plasma amino acids 280
role of hypothalamus in release of 4
Interplexiform cells 58
dopamine in 81
glycine in 66
Intra-axonal transport 6
hypothalamus 8
Invertebrates
excitatory amino acids 199
excitatory amino acid receptors 242
glutamate activated ion channels 234
opioid neurobiology 131–159
senescent alterations 146
Ion channels
glutamate activated in invertebrates 234
linked to kainate and quisqualate receptors 233
linked to NMDA receptors 229
Iontophoretic vs mechanical tracer injection 7

Kainate, effect in retina 61, 64
Kainic acid receptor 200
desensitization 241
γ-glutamylglycine and related peptides 204
ion channels linked to 233
voltage clamp 218
Ketamine, NMDA receptor antagonist 205
Kynurenic acid 248, 250

Lateral hypothalamic area
descending autonomic connections 35
intrahypothalamic connections 20
limbic input 8
Leucophaea maderae, opioid binding sites 140
Limbic system
input to lateral hypothalamic area 8
input to paraventricular hypothalamic nucleus 14
input to ventromedial hypothalamic nucleus 8
position of hypothalamus 2
Liver, encephalopathy
amino acids in treatment 293
brain and CSF amino acid levels 285
plasma amino acid imbalance 278
role of blood–brain barrier 288
Locomotion, H-reflex during 355
Locomotion–posture integration, awake cat 180
volitional control 184
Locomotion–posture integration, decerebrate cat 163
autonomic control system 171
modification 165
Locomotor phase control system 178
Locomotor rhythm releasing system 171
Locomotor synergism 186
Locust, glutamate activated ion channels 234
Long-term potentiation, role of excitatory amino acid receptors 254
Lymnea stagnalis, opiate mechanisms 143

Mannitol, blood–nerve barrier 332
Melatonin, in retina 85
Mesencephalic locomotor region 163, 185
reticulospinal pathway 172
Metabolic regulation, role of hypothalamus 4
Methionine, in plasma in liver disease 278
N-Methyl-D-aspartic acid
firing patterns and bursting behaviour evoked by 226
membrane conductance changes evoked by 223
N-Methyl-D-aspartic acid receptors
agonists and antagonists 201, 221
anaesthetic effects 205
calcium permeability 238
cultured spinal neurons 213
current clamp conductance measurements 215
desensitization 241
effect of divalent cations 206
function 260
ion channels linked to 229
pathophysiology 262
in retina 59, 63
role in long-term potentiation 255
synaptic transmission 244, 252
vertebrate–invertebrate differences 199
voltage clamp 219
5-Methyl-4-isoxazolepropionic acid 204
Mg^{2+}, sensitive and insensitive excitatory amino acid receptor subtypes 201, 203, 206, 220, 229
Midpontine structures
cells of origin projecting axons to 168
neural substrates 167
plastic postural changes 165
Molluscs, opioids in 140, 149
Monosynaptic reflex 350
Motoneurons
control of reflex excitability 361
H-reflex 347, 356
recurrent inhibition 359
Motoneurone vs reflex arc excitability 350
Mudpuppy, glycine in retina 69
Muscarinic receptors, organophosphorus sensitivity 108, 119
Muscle, skeletal, H-reflexes 345, 349, 360
Mytilus edulis
enkephalins in pedal ganglia 132, 137
opiate receptor sites 138
opioid–dopamine interactions 140, 143
opioids in 150
opioids and aging 146

Naloxone, binding in invertebrates 138
Neck receptor influences on H-reflex 355
Neocortex, synaptic activation of NMDA receptors 252
Nerve capillaries
morphology 305
permeability 329
Nerve edema
role of capillaries 329
role of perineurium 316
Nerve, peripheral, microenvironment 303–345
Nerve vascular permeability in hypertension 306
Neuroanatomical methods 6
Neurotransmitters
blood–brain barrier 289
false, hepatic encephalopathy 281
in retina 55–96
Neurotransmitter interactions, organophosphorus effects 109, 121
Nicotinic acetylcholine receptors
desensitization 243
effect of organophosphorus compounds 120
Non-critical binding protein, organophosphorus sensitivity 106
Noradrenergic input to hypothalamus 14
Noradrenaline, role in hepatic failure 282, 283

Octopamine
false neurotransmitter 282
neurological depression 288
Olfactory cortex, excitatory amino acids and synaptic transmission 251
Opioids, in invertebrates
aging 146
anatomical studies 149
behaviour 149
binding analysis 138
cyclic AMP alterations 144
evolutionary considerations 152
HPLC 132
macromolecular precursor 137
neurophysiology 142
neurotransmitter release 143
pharmacological alterations 140
seasonal variations 151
Opioids, mammals, aging 144, 146, 147
Opioids, role in organophosphate anticholinesterase action 110
Organophosphorus anticholinesterase compounds, sensitivity mechanisms 97–129
cholinergic systems 99
immediate effects of exposure 102

acetylcholinesterase binding 105
blood–brain barrier changes 111
cholinergic stimulation 103
glucose utilization and acetyl CoA 107
muscarinic receptors 108
neuronal damage 110
neurotransmitter interactions 109
non-critical binding proteins 106
post-receptor mechanisms 108
prolonged exposure effects 112
acetylcholine and choline levels 118
acetylcholine release 119
adaptive processes 112
behaviourally augmented tolerance 121
cholinesterase activity 115
choline uptake and acetylcholine synthesis 117
muscarinic receptor changes 119
neurotransmitter interactions 121
nicotinic receptor changes 120
post-receptor mechanisms 120
selective modification of cholinesterase isoenzymes 117
tolerance 114, 121
Outer plexiform layer 57
electrophysiology 60

Pain sensitivity, aging 147
Pancreas
hypothalamic connections 26
preganglionic innervation 42
Parathion, biotransformation 103
Paraventricular hypothalamic nucleus
descending autonomic connections 38
forebrain limbic input 14
intrahypothalamic projections of 24
metabolic regulation and the adrenal hormones 4
projections to adeno- and neurohypophysis 26
Parvocellular reticular formation, spinal projections from 33
Patch clamp 199
Peptides, transmitter role in retina 86
Periaqueductal gray 27, 49
Perineurium
electrical properties 315
morphology 304
nerve edema 316
permeability to ions 325
permeability to sucrose 324
quantitative approach to barrier permeability 321
effect of stretch and hypertonicity 324
Wallerian degeneration 329
Peripheral nerve, microenvironment 303–343
endoneurial capillaries 305, 329
perineurium 304, 315
Phaseolus vulgaris leuco-agglutinin 7, 15, 18
Phencyclidine 205
Phenylalanine
in CSF in hepatic encephalopathy 287
in plasma in liver disease 278
Phenylethanolamine, role in hepatic encephalopathy 282
Phenylisothiocyanate 136
Phenylketonuria, H-reflex in peroneal muscles 349
Photoreceptor cells 56
dopamine receptors in 82
glutamate and aspartate in 59
indole systems in 85
cis-2,3-Piperidine dicarboxylic acid 247
effect in retina 61, 63
Pituitary, opioids and aging 146
Pons
cells of origin projecting axons to 168
neural substrates 167
plastic postural changes 165
Ponto-bulbar locomotor region 172
Portocaval anastomosis, hepatic encephalopathy model 285
Postural tonus regulatory system 173
Posture–locomotion integration, awake cat 180
volitional control 184
Posture–locomotion integration, decerebrate cat 163
autonomic control system 171
modification 165
Potassium
effect of excitatory amino acids on fluxes 237
nerve capillary permeability 331
perineurial permeability 327
Power control system 173
excitatory 176
inhibitory 174
Prefrontal cortex, projections to hypothalamus 11
Pregnancy, effects of organophosphorus anticholinesterases 120
Presynaptic inhibition of reflex arc 351
Primary afferents, effect of excitatory amino acid antagonists 248
Prodynorphin 133
Proenkephalin 133
Proopiomelanocortin 132
Purkinje cells, response to excitatory amino acids 211
Pyramidal neurons, response to excitatory amino acids 211

Quisqualate, effect in retina 61, 64
Quisqualic acid receptors 200
desensitization 241
glutamic acid diethylester 204
ion channels linked to 233
voltage clamp 218

Rabbit
glycine in retina 70
role of acetylcholine in retina 74
Reciprocal innervation 356
Recurrent inhibition 359
Reflex arc
excitability and muscle contraction 360
presynaptic inhibition 351
Reflex effects from distant sources 353
Reflex standing 162
Renshaw cells 175, 359
Retina, effect of 2-amino-4-phosphonobutyric acid 259
Retina, transmitter circuits
acetylcholine 74
dopamine 80
GABA 70
glutamate and aspartate 59
glycine 65
neurons 56
peptides 86
serotonin 83

Retrograde tracer techniques 6
  hypothalamus 8
  midpontine structures 168

Sciatic nerve
  endoneurial capillaries 305, 317, 329
  permeability of perineurium 322
Seasonal variation, invertebrate opioid metabolism 151
Seizures, role of excitatory amino acids 262
Sensitivity to organophosphorus compounds 98, 103
Sensory receptors, effect of excitatory amino acid antagonists 248
Sex differences, sensitivity to DFP 106
Single channel recording 227
Sleep, H-reflex 353
Sodium
  effect of excitatory amino acids on fluxes 236
  permeability of nerve capillaries 331
  permeability of perineurium 325
Soleus muscle, H-reflex 346
Soman, effect on glucose utilization 107
Somatostatin, effect in retina 87
Spinal cord
  synaptic activation of NMDA receptors 253
  synaptic transmission and non-NMDA receptors 247
Spinal neurons, cultured
  excitatory amino acid action 212
  excitatory postsynaptic currents 260
  voltage clamp 218
Spinal projections from ventromedial reticular formation 31
Spinal reflexes, locomotion 355
Spino-cerebellar loop 172, 178
Starburst amacrine cells 75
Step cycles 179
D-α-Suberic acid 204
Substance P, effect in retina 87
Substantia grisea centralis 27, 28
Subthalamic locomotor region 185
Sucrose
  permeability of nerve capillaries 330
  permeability of perineurium 324
Supraspinal loop 348
Synaptic transmission, excitatory amino acids 244
  NMDA receptors 252
  non-NMDA receptors 245

Tolerance, organophosphorus anticholinesterases 112, 114, 121
Tracer techniques 6
  hypothalamus 8, 18
  midpontine structures 168
T-response 351
Tryptophan, role in hepatic encephalopathy 284
Tyrosine, in plasma in liver disease 278

Ventral premamillary nucleus, intrahypothalamic connections 25
Ventral spino-cerebellar tract 178
Ventromedial hypothalamic nucleus
  autonomic connections 27
  intrahypothalamic connections 18
  limbic input 8
Ventromedial reticular formation, spinal projections from 31
Vestibular influences on H-reflex 354
Vestibulospinal tract 179
Vibration reflex 352
Visual influences on posture 188
Volitional postural and locomotor control in awake cats 184
Voltage clamp 199, 217, 227
Voluntary movement, modulation of H-reflex excitability 356

Walking, vestibulospinal neurons 179
Wallerian degeneration, perineurial permeability changes 329
Wheat-germ agglutinin-horseradish peroxidase 6
Withdrawal, anticholinesterases 114